

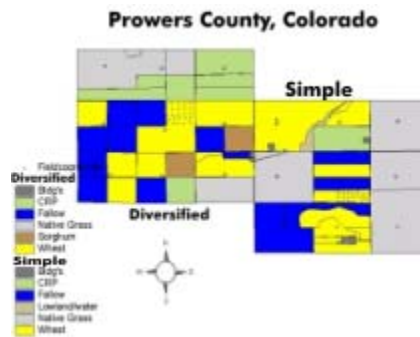
## 1. Demonstration Component Summaries

### a. Colorado Demonstration Sites

*Prowers County, CO*

*Phase II, Year 1 (2002-2003)*

*Written by Laurie Kerzichnik*



## Crops Involved in the Rotation

### Simple-rotation field -Wheat

The field to the right is a grower who uses simple rotation. He has strips of wheat/fallow, and 80 acres were used for sampling.

### Diversified Field-Wheat & Sorghum

The grower to the left grows wheat and grain sorghum, which is a diversified field. The wheat sampled was 160 acres of Prairie Red. The sorghum was also 160 acres.

## Aphid Overview

In the wheat, aphids were sampled monthly from March through June. The dominant aphid for both cooperators was *D. noxia* (Table 1). *Rhopalosiphum padi* was also present in low densities. The grower of the simple-rotation field had more *D. noxia* in his field in early June, but aphid densities were extremely low and far from damaging levels. It is difficult to compare aphid densities with both fields, as populations were minimal.

**Table 1. No. aphids for either field in wheat. Total no. aphids= sum of aphids for 25, 1-ft rows, measured by Berlese funnels.**

Date	Aphid	Diversified	Simple
3/26/2003	<i>D. noxia</i>	4	14
	<i>S. graminum</i>	0	0
	<i>R. padi</i>	0	0
4/24/2003	<i>D. noxia</i>	77	15
	<i>S. graminum</i>	0	0
	<i>R. padi</i>	0	18
5/14/2003	<i>D. noxia</i>	33	36
	<i>S. graminum</i>	0	0
	<i>R. padi</i>	20	3
6/10/2003	<i>D. noxia</i>	53	183
	<i>S. graminum</i>	0	1
	<i>R. padi</i>	0	0

In the sorghum, aphids were sampled during late whorl, flowering, and grain fill in the diversified field. *Schizaphis graminum* was present in early August and were replaced by *R. maidis* in October (Table 2). Aphid numbers were relatively low; however, greenbug damage was evident by red spotting on several of the plants.

**Table 2. No. aphids per 10 benchmark samples at the diversified field (grain sorghum) (3 plants per benchmark).**

	Crop Stage	<i>S. graminum</i>	<i>R. maidis</i>
8/12/03	Late Whorl	236	0
9/15/03	Flowering	10	0
10/8/03	Grainfill	0	250

### Natural Enemies

In the wheat, predators were abundant. The major predators are shown in Table 3. Spiders comprise the greatest number of predators, followed by nabids, coccinellids, and minute pirate bugs, *Orius* sp. This pair of demonstration sites is interesting because predator densities are higher with the diversified grower in all categories.

**Table 3. No. predators in wheat for either field. Each date represents a total for 625 sweep net samples per site (at 25 points). (D=Diversified field; S=Simple field)**

	Nabidae		Spiders		Coccinellidae		Coccinellidae (imm.)		Green Lacewing		<i>Orius</i> sp.	
Date	<i>D</i>	<i>S</i>	<i>D</i>	<i>S</i>	<i>D</i>	<i>S</i>	<i>D</i>	<i>S</i>	<i>D</i>	<i>S</i>	<i>D</i>	<i>S</i>
5/14/03	174	149	564	430	49	10	2	18	0	0	8	8
5/28/03	194	150	237	138	42	27	11	5	3	0	7	9
6/09/03	40	58	148	99	14	9	1	0	0	0	0	0
6/23/03	20	10	49	26	0	0	0	0	1	0	0	0
<b>Total</b>	<b>428</b>	<b>367</b>	<b>998</b>	<b>693</b>	<b>105</b>	<b>46</b>	<b>14</b>	<b>23</b>	<b>4</b>	<b>0</b>	<b>15</b>	<b>17</b>

For sorghum, predators were sampled during late whorl, flowering, and grainfill. Fifty sorghum plants were sampled at each benchmark. Both coccinellids and the spider mite destroyer, *Stethorus punctillum*, were present at all sampling times; however, densities were very low.

## Other Pests

The wheathead armyworm appeared in the diversified grower's field on May 14, 2003 in the wheat. Populations increased in sweep net samples for both cooperators after this date (Table 4). Although little is known about the wheathead armyworm, it is known that the first generation larvae feed on foliage before heading and feed on the heads as they develop.

**Table 4. No. wheathead armyworms per 625 sweeps for each date and cooperator. (S=Simple field; D=Diversified field)**

	S	D
5/14/03	0	2
5/28/03	1072	514
6/9/03	448	317
6/23/03	94	123

In the sorghum, there weren't any major pests present besides aphids. Sampling for headworms was conducted late in the sorghum crop stage, but no headworms were found.

## Weeds

Weeds were sampled before wheat jointing, before harvest, and after harvest both within the field and along the borders. Weed densities were close to zero before jointing both within the field and the border for both fields. Before harvest, the conventional grower's field had very few weeds. The diversified grower's field, however, had heavy bindweed infestations in the field but no significant weeds along the border. After harvest, weeds were very high within both fields. Along the field borders, the conventional grower had heavy infestations of *Bromus* sp. and jointed goatgrass along the west. The diversified grower had high infestations of *Bromus* sp. along the southern and eastern borders of his field.

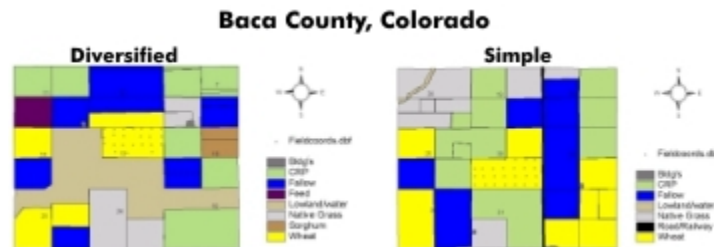
Although we did not sample weeds in sorghum, it should be noted that field sandbur densities were extremely high. The sandburs were present in every area of the field, including the benchmark areas.

## Summary

The notable aspect of this pair of sites is the greater density of predators with the diversified grower. The aphid numbers were at a minimum for both cooperators. The wheathead armyworm was present in high densities in late May/June at both sites. Weed densities were high close to harvest within the field, and *Bromus* species and jointed goatgrass were present along the field borders around harvest time.

We have made an effort to broaden communications with both growers. When the project started, I met the diversified grower for breakfast to discuss the project. We visited the conventional grower at his home to ask questions and describe the goals of the research. We have provided both cooperators with soil and climatic data for the year. Both cooperators seem genuinely interested in the project and the pests, predators, and weeds we find.

***Baca County Colorado***  
***Phase II, Year 1 (2002-2003)***  
***Written by Hayley R. Miller***



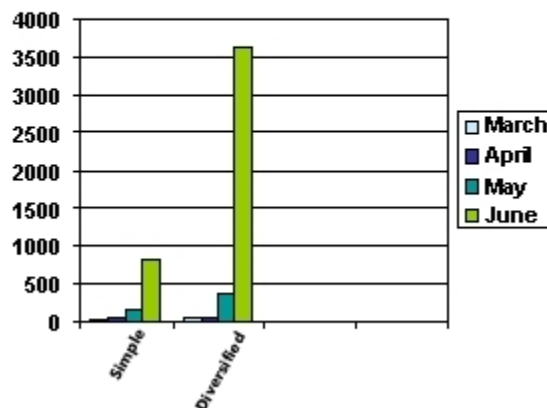
*Crops involved in rotation:* Wheat-Fallow, Wheat-Sorghum-Fallow

The field on the right is our simple-rotation field, where the cooperators are growing Hard Red winter wheat, Prairie Red and Halt. The field on the left is our diverse field, where the cooperators are growing Hard Red Winter wheat (Certified Prairie Red), rotated with grain sorghum and fallow.

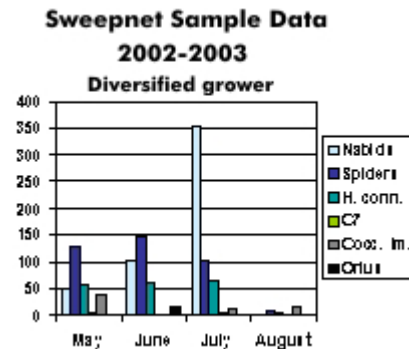
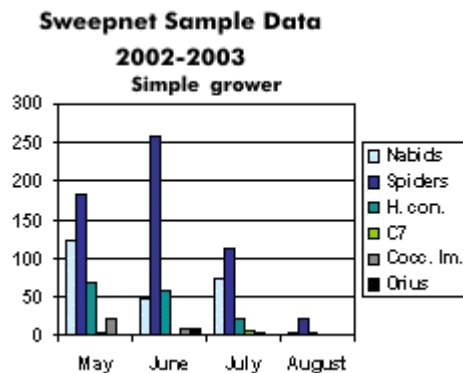
*Russian wheat aphid status:* Russian wheat aphids were present at both farms. The simple-rotation field had little Russian wheat aphid pressure at the end of May and in June. A biotype of the Russian wheat aphid was found in the diversified field. Four months of Berlese sample data shown below were taken from 25 1ft. row samples at each location. When aphids were found samples were taken and put in emergence canisters, no parasitoids were found at either site. This year drought was a problem in wheat production.

## Russian wheat aphids 2002-2003

### Berlese Sample Data



*Natural enemies:*



Twenty-five 180 degree sweeps were taken at each of the 25 points at each location. The majority of natural enemies were nabids, spiders, coccinellids and minute pirate bugs.

*Other pests:* Simple-In addition to Russian wheat aphids the conventional field had eight Bird Cherry Oat aphids and one greenbug in the April Berlese samples. The table below gives the Berlese samples counts for Banks Grass Mite, Brown Wheat Mite and Thrips.

	27 March	21 April	13 May	9 June
BGM	0	8	6	0
BWM	0	0	12	0
Thrips	0	84	833	676

Twenty-five 180 degree sweeps were taken at each of the 25 points at each location and the number of Wheat Head Army Worms caught is shown in the table below.

	13 May	27 May	10 June	24 June
WHAW	0	70	452	254

Diverse-In addition to Russian wheat aphids the diversified field had 23 Bird Cherry Oat Aphids in the June Berlese samples. The table below gives the Berlese samples counts for Banks Grass Mite, Brown Wheat Mite and Thrips.

	27 March	21 April	13 May	9 June
BGM	0	39	8	0
BWM	0	0	33	0
Thrips	0	275	1569	1699

Twenty-five 180 degree sweeps were taken at each of the 25 points at each location and the number of Wheat Head Army Worms caught is shown in the table below.

	13 May	27 May	10 June	24 June
WHAW	0	341	1305	188

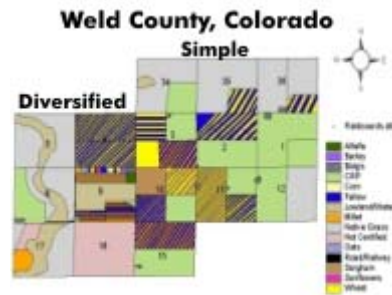
*Weed situation in wheat:* Zero to fourteen days before jointing there was little weed pressure at either site. Zero to fourteen days before harvest the simple-rotation field had 3 to 10+ weeds at each of the 25 sampling points and wheatgrass and jointed goat grass pressure on east and west borders of the field. Zero to 14 days after harvest this field had 1 or 2 patches of volunteer wheat on his west border and patches of *Bromus* species ranging from 1 or 2 plants to 10 or more on north, east and west borders. Zero to fourteen days before harvest the diversified field had 3 to 10+ weeds at each of the 25 sampling points and little *Bromus* pressure on the west border of the field. Zero to 14 days after harvest the diversified had high *Bromus* pressure on south, east and west borders and jointed goat grass pressure on all borders.

*Sorghum:* Fifteen plants were examined at ten points throughout the field and sampled for aphids and beneficial insects. At late whorl stage corn leaf aphid pressure was high at the diversified field, averaging 30 aphids per each of the 15 plants at each of the 10 locations. Nabids, lacewings immature and adults stages, flea beetles, spiders, tenebrionids, coccinellids, plants hoppers, minute pirate bugs, and thrips were all observed in small numbers on the sorghum plants at late whorl and flowering stages. Corn leaf aphid pressure was less at flowering stage averaging 10 aphids per plant. Sorghum was harvested before corn earworm and fall armyworm could be sampled, yield was not obtained due to early harvest.

*Weed situation in sorghum:* Occasional sandbur nothing of concern.

*Summary of overall findings and important observations:* A biotype of the Russian wheat aphid was found in the diversified field in Baca County. Wheat head army worm counts were high at both sites. A breakfast meeting was held in Springfield Colorado at the Longhorn Steakhouse to discuss the project status with both growers. The grower with the diversified field was unable to attend due to sorghum planting. The grower with the simple-rotation field, Laurie Kerzicnik and I attended the meeting and relayed important information to both parties such as planting dates, yields, insects and weeds present. Both cooperators are showing interest and enthusiasm in this project. Yield information is not yet complete for both cooperators.

**Weld County, CO**  
**Phase II, Year 1 (2002-2003)**  
**Written by Laurie Kerzicnik**



## Crops Involved in the Rotation

### Simple Rotation-Wheat

The grower with the simple-rotation field maintains the wheat/fallow rotation for this pair of demonstration sites. His wheat is in a half-section of stripped wheat/fallow, which equals approximately 160 acres of wheat. The variety planted is primarily Scout 66, although there is a variety trial with several wheat varieties in one of the wheat strips.

### Diverse field-Wheat, Millet & Sunflower

This is the grower with the diversified field for this county. This is a unique site because it is part of a USDA/CSU diversified cropping systems study. The purpose of the study is to determine the effect of diverse cropping systems on integrated pest management and the effect of shorter fallow periods on cropping systems.

There are four rotations in this study-wheat/fallow, wheat/millet/fallow, wheat/wheat/corn/corn/sunflower/ fallow, and opportunity cropping. The wheat/fallow and wheat/millet/fallow are rotations that are typically seen in Colorado. For this study, we used four plots of wheat and four plots of millet that were in the wheat/millet/fallow rotation. The plots are replicated such that there are four replications of wheat, four of millet, and four of fallow.

*Wheat:* We divided our 25 sampling points among the four wheat plots.

*Sunflower:* This is part of the wheat/wheat/corn/corn/ sunflower/fallow rotation. There were four sunflower plots, and we sampled 15 plants in each plot.

*Millet:* The millet was not sampled in this study. The millet was harvested due to adverse conditions and was sprayed before the first sampling could occur.

## Overview of the Aphid

Aphids were sampled from April through June. The primary aphid is the Russian wheat aphid, *Diuraphis noxia* Mordvilko. The greenbug, *Schizaphis graminum* Rondani, and the bird cherry oat aphid, *Rhopalosiphum padi* L., were also present, but their populations were extremely low. Table 1 shows *D. noxia*, *R. padi*, and *S. graminum* and their densities for each grower. The diversified field had a peak of *D. noxia* in late May where the simple-rotation field had higher densities in June. The simple rotation also had a greater density of *R. padi*.

**Table 5. Aphids for Weld County Cooperators, diversified and simple rotation in wheat. Total # aphids=sum of aphids for 25, 1-ft rows, measured by Berlese funnels. (D=Diversified field; S=Simple field)**

Date	Aphid	D	S
4/15/2003	<i>D. noxia</i>	9	4
	<i>S. graminum</i>	0	0
	<i>R. padi</i>	0	0
5/22/2003	<i>D. noxia</i>	911	125
	<i>S. graminum</i>	0	0
	<i>R. padi</i>	0	11
6/26/2003	<i>D. noxia</i>	634	889
	<i>S. graminum</i>	4	2
	<i>R. padi</i>	3	34

### Natural Enemies

For the diversified and conventional farmers, natural enemies were prevalent in wheat. There are no apparent differences in natural enemy densities between cooperators. Table 2 shows the major predators for wheat from 5/19/03-7/9/03. The dominant natural enemy for both cooperators was *Orius* sp. (minute pirate bug). When populations of *Orius* diminished, nabids, spiders, and coccinellids densities remained constant. The green lacewing was present but at low densities.

**Table 6. Predators in wheat for both diversified and conventional. Each date represents a total for 625 sweep net samples per site (at 25 points). \*The wheat in the diversified field was harvested before 7/9/03, so there were no sweep net samples for this time. (D=Diversified field; S=Simple field)**

	Nabidae		Spiders		Coccinellidae		Coccinellidae (imm.)		Green Lacewing		<i>Orius</i> sp.	
Date	D	S	D	S	D	S	D	S	D	S	D	S
5/14/03	6	8	13	14	3	15	0	1	1	0	282	401
5/28/03	23	43	29	15	10	26	2	0	3	0	54	8
6/9/03	20	2	31	11	14	13	0	28	0	0	0	2
6/23/03	*	5	*	15	*	12	*	10	*	0	*	1
Total	49	58	73	55	27	66	2	39	4	0	336	412

### Other Pests

In the wheat, brown wheat mites, *Petrobia latens* Mueller, were found at both sites but densities were very low. Thrips were also found at low densities.

For sunflower, surveys were taken twice in August 2003 before the late bud stage to look for the headclipper moth and the grey and red sunflower weevils. The headclipper moth was not present, and the grey and red weevil populations were at a minimum (averaging less than one per head). Sunflower headmoths were sampled two weeks after the plants reached the 5.9 stage, and the headmoths averaged 10-50 per head in the four benchmark areas. At plant maturity, stem weevils and borers were sampled in the stalk. Stem weevils and stem borers densities were low, averaging less than five per head. Overall, the sunflowers looked relatively healthy for dryland cropping, showing little sign of pest infestation or damage.

### Weeds

Weed counts were conducted before wheat jointing, before harvest, and after harvest. Before wheat jointing, there were almost no weeds present within either of the growers' fields or

along their field borders. Before harvest, weeds were consistently high within the simple-rotation field, averaging about 10 weeds per  $\frac{1}{2}$  meter squared. In this field border, *Bromus* sp., jointed goatgrass, and volunteer wheat densities were high. The diversified field had fewer weeds at this time, with an average of three weeds per  $\frac{1}{2}$  m<sup>2</sup>. However, the field did not have any significant weeds along the field borders. After wheat harvest, weeds were numerous in the conventional grower's field within the 10 most westerly points but declined to about three weeds per  $\frac{1}{2}$  m<sup>2</sup> for the remaining 15 sampling points. The field borders maintained high densities of *Bromus* sp., jointed goatgrass, and volunteer wheat. Weeds in the diversified field remained at about three per  $\frac{1}{2}$  m<sup>2</sup> throughout the field and low around the field borders.

## Summary

For this pair of sites, aphid and natural enemy densities were comparable between the fields. Weed densities were somewhat higher before and after harvest within the field and along the field border for the simple-rotation field. Other pest populations remained low at both sites. Although the millet was harvested before samples could be taken, it does represent the opportunistic approach that most growers take when adverse crop conditions exist.

We have taken measures to extend communications with the cooperators. At the start of the project, we met the grower of the diversified field for breakfast to talk about the project and the work we would conduct in his field. At the beginning of this year, Hayley Miller and I helped the grower of the simple-rotation field plant CSU wheat variety trials at the site where we are sampling; he needed two extra hands to help load the seed. In addition, we have sent both cooperators copies of the soil and climatic data collected at their sites. These extended interactions have helped to establish good contacts with the cooperators and give the project a good name. By providing data and help when necessary, I believe we are returning the favor for the use of their fields. Both growers have taken an interest in the project, attending field days, asking questions while we are in the field, and responding to our information requests.